

USER'S GUIDE

MACHINIST CALC™ PRO

ADVANCED MACHINING MATH AND REFERENCE TOOL

Model 4087



**CALCULATED
INDUSTRIES®**

FAST. ACCURATE. RELIABLE.

MACHINIST CALC™ PRO

The *Machinist Calc™ Pro* Advanced Machining Math and Reference Tool (Model 4087) provides fast, precise solutions for your every day machining calculations. With the *Machinist Calc Pro* you will spend less time looking up your most-needed calculations on charts, in books or on the Internet and more time machining.

The *Machinist Calc Pro* gives you hundreds of machining-specific calculations, including:

- Cutting Speed, Spindle Speed (RPM)
- Feed Rate, Cutting Feed, Feed per Tooth (Chip Load)
- Built-in Drill and Thread Size reference tables
- Drill Point Cut Depth solutions
- Wire Sizes and 3-Wire Measurements
- Bolt Pattern hole layouts with center x, y coordinate
- Right triangle math
- Trigonometric solutions
- Work in and convert between U.S. and Metric units, including:
 - Decimal Inches/Mils
 - Feet-Inch-Fractions
 - m, mm, cm
 - Area, Volume and Weight

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GETTING STARTED

You may want to practice getting a feel for your calculator keys by reading through the key definitions and learning how to enter data, how to store values, etc., before proceeding to the examples.

KEY DEFINITIONS

Basic Function Keys

On/C

On/Clear Key — Turns on power. Pressing once clears the last entry and the display. Pressing twice clears all non-permanent values.

Off

Off — Turns all power off. Clears all non-permanent values.

+ - × ÷ =

Arithmetic operation keys.

0 - 9
and **.**

Keys used for entering numbers.

Conv

Convert — Used with the dimensional keys to convert between units or with other keys to access special functions.

Stor

Store — Used for storing values.

Stor

1 - 9

Storage Registers M1 through M9 — Used to store values in Memory registers 1 through 9.

Rcl

Recall — Used with other keys to recall stored values and settings.

Conv Rcl

Memory Clear (M-R/C) — Clears Accumulative Memory without changing current display.

Rcl Rcl

Memory Clear — Clears Accumulative Memory and displays total.

M+

Accumulative Memory — Adds displayed value to Accumulative Memory.

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M- — Subtracts displayed value from Accumulative Memory.

Dimensional Function Keys



Millimeters — Identifies entry as millimeters, with repeated presses toggling between linear, area and volume units. Converts dimensional value to units of millimeters, with repeated presses toggling between millimeters and meters.



Centimeters (cm) — Identifies entry as centimeters, with repeated presses toggling between linear, area and volume units.



Meters (m) — Identifies entry as meters, with repeated presses toggling between linear, area and volume units.



Feet — Identifies entry as Feet, with repeated presses of toggling between linear, area and volume units. Also used with and for entering Feet-Inch values. Repeated presses of during conversions toggle between fractional Feet-Inch and decimal Feet.



Inch — Identifies entry as Inches, with repeated presses toggling between linear, area and volume units. Entry can be whole or decimal numbers. Also used with for entering fractional Inch values (e.g.,). Repeated presses during conversions toggle between fractional and decimal Inches.



Fraction Bar — Used to enter fractions. Fractions can be entered as proper (1/2, 1/8, 1/16) or improper (3/2, 9/8). If the denominator (bottom) is not entered, the calculator's fractional accuracy setting is automatically used. Results are always shown in typical dimensional fractional format.

/1000"

1/1000" (mils) — Multiplies a dimensionless entry by 0.001 Inch and displays the result as Inches. Converts a linear entry to decimal Inches. For both methods, the result is rounded and displayed to three decimal places

Weight and Volume Function Keys

Conv 6

Tons — Enters or converts a weight or volume value to tons.

Conv 4

Pounds (lbs) — Enters or converts a weight or volume value to pounds.

Conv 3

Metric Tons (met tons) — Enters or converts a weight or volume value to metric tons.

Conv 2

Grams — Enters or converts a weight or volume value to grams.

Conv 1

Kilograms (kg) — Enters or converts a weight or volume value to kilograms.

Conv 0

Weight per Volume (wt/vol) — Stores a new weight per volume as pounds per cubic foot or other format as shown below. Default value is 490 pounds per cubic foot of steel.

- Pounds per cubic foot
- Pounds per cubic inch
- Metric tons per cubic meter
- Kilograms per cubic meter

Trigonometric Function Keys

Conv #Teeth

Sine — Calculates the Sine of an entered degree or unitless value.

Conv Adj/Co

Arcsine (ArcSine) — Calculates the angle for the entered or calculated Sine value.

Conv Feed/Tooth

Cosine (Cos) — Calculates the Cosine of an entered degree or unitless value.

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Arccosine (ArcCos) — Calculates the angle for the entered or calculated Cosine value.



Tangent (Tan) — Calculates the Tangent of an entered degree or unitless value.



Arctangent (ArcTan) — Calculates the angle for the entered or calculated Tangent value.

Miscellaneous Functions



Degrees:Minutes:Seconds (dms \leftrightarrow deg) — Converts between D:M:S and decimal degree formats; repeated presses will toggle between the two formats.



Percentage — Used to find a given percent of a number.



x^2 — Squares the value on the display.



Backspace Function — Used to delete entries one keystroke at a time (unlike the **On/C** function, which deletes the entire entry).



Square Root (\sqrt{x}) — Calculates the Square Root of the number on the display.



Reciprocal ($1/x$) — Finds the Reciprocal of a number (e.g., $8 \text{ } \text{Conv} \text{ } \div \text{ } = 0.125$).



Clear All — Returns all stored values to the default settings. Does not affect Preference Settings.



Change Sign (+/-) — Toggle displayed value between negative and positive value.



Pi — Displays value of π (3.1415927).



Paperless Tape (Tape) — Accesses the Paperless Tape mode (see **Paperless Tape** section), which keeps track of your past 30 entries. Useful for checking strings of numbers.



Preference Settings (Prefs) — Accesses various customizable settings, such as dimensional answer formats (see **Preference Settings** section).

Machinist Function Keys



Cutting Speed — Enters or calculates Cutting Speed. Unitless entries assumed feet per minute in U.S. mode; meters per minute in Metric mode. Calculates Cutting Speed given entered Diameter and RPM (Spindle Speed). Result is displayed as a whole number.



Radial Chip Thinning (RCT) — Enters a Cut Depth and calculates a Radial Chip Thinning factor to increase the Feed Rate given Feed Per Tooth, Tool Diameter and a Cut Depth that is less than one-half the Tool Diameter. Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode.



Revolutions per Minute — Enters or calculates RPM (Spindle Speed). Calculates RPM given entered Diameter and Cutting Speed. Result is displayed as a whole number.



3-Wire Measurement (3-W Measure) — Enters or calculates a Three-Wire Measurement. Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode. Calculates the minimum and maximum Three-Wire Measurements and Pitch Diameters given entered Thread Size and Wire Size, assuming an External thread type. If a Three-Wire Measurement value is entered, the Pitch Diameter calculation is based on this entered measurement.

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**Feed
Rate**

Feed Rate — Enters or calculates Feed Rate. Unitless entries assumed inches per minute in U.S. mode; millimeters per minute in Metric mode. Calculates Feed Rate given values for Cutting Feed and RPM (Spindle Speed) or Feed per Tooth (Chip Load), RPM and Number of Teeth.

Conv **Feed
Rate**

Wire Size — Enters or calculates Wire Size for 3-Wire Measurements. Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode. Calculates the recommended Ideal, Maximum and Minimum Wire Sizes given an entered Thread Size.

**Bolt
Pattern**

Bolt Pattern — Enters the number of holes in a Bolt Pattern. Calculates the hole Center-to-Center Spacing and the x and y coordinates for each hole in a Bolt Pattern given entered Diameter, Number of Bolt Holes, Starting Angle (optional) and Center x and y coordinates (optional).

Conv **Bolt
Pattern**

Thread Classification (Thread Class) — Used to select the Thread Class for numeric and fractional Threads and the Tolerance Class for metric Threads. The default Class for numeric and fractional Thread Sizes is 2B (Internal) and the default Tolerance Class for metric Thread Sizes is 6H (Internal). See **Thread Sizing** section for further details on available Classes.

**Thread
Size**

Thread Size — Enters a numeric, fractional or metric Thread Size and provides Thread characteristics such as Cut Tap Drill Size, Minimum Major Diameter, etc. See **Thread Sizing** section for further details on entry format, valid entries and a listing of the resulting Thread characteristics.



% Thread — Enters a non-standard Thread Grip Percentage for use in determining screw Tap Drill Sizes. Default value is 75%.



Drill Size — Enters a numeric, letter, fractional or metric Drill Size, displaying the decimal Inch (U.S. mode) or millimeter (Metric mode) equivalent of the Drill Size. The next smaller Drill Size is displayed if the entered value doesn't match a Drill Size. Repeated presses of or toggle through Drill Sizes in increasing order. Presses of toggle through Drill Sizes in decreasing order. Selected Drill Size is stored upon exiting function.



Drill Point — Enters the Cutting Angle of a Drill Point. Calculates the Drill Point Cut Depth that needs to be taken into account when it's necessary to maintain a specific full diameter depth.



Number of Teeth — Enters the Number of Teeth on a tool. Default value is 1.



Feed per Tooth — Enters or calculates Feed per Tooth (Chip Load). Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode. Calculates Feed per Tooth given entered Cutting Feed and Number of Teeth or RPM (Spindle Speed), Feed Rate and Number of Teeth.



Cutting Feed — Enters or calculates Cutting Feed. Unitless entries assumed inches per revolution in U.S. mode; millimeters per revolution in Metric mode. Calculates Cutting Feed given entered Feed per Tooth (Chip Load) and Number of Teeth or Feed Rate and RPM (Spindle Speed).

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Diam

Diameter — Enters a Diameter. Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode. Calculates circle Area and Circumference given entered Diameter. Calculates Diameter given entered Radius.

Conv Diam

Radius — Enters or calculates a Radius. Unitless entries assumed Inches in U.S. mode; millimeters in Metric mode. Calculates Radius given entered Diameter.

Conv 8

Alpha — Enters alphabet character selection mode. While in this mode, a letter can be selected and used with **Drill Size** to enter a letter Drill Size. Entering this mode with a unitless entry between 1 and 26 will display the corresponding letter of the alphabet (i.e. **5 Conv 8** displays the letter **E**). While in Alpha mode, presses of **8** or **+** toggle forward through the alphabet, while presses of **=** toggle backward.

Adj
xy

Adjacent (x) — Enters or calculates the Adjacent (horizontal) leg of a right triangle. Calculates Adjacent value given two other right-triangle values. Also enters the Center x-coordinate of a Bolt Pattern.

Opp
xy

Opposite (y) — Enters or calculates the Opposite (vertical) leg or height of a right triangle. Calculates Opposite value given two other right-triangle values. Also enters the Center y-coordinate of a Bolt Pattern.

Hyp
xy

Hypotenuse (r) — Enters or calculates the Hypotenuse (diagonal) of a right triangle. Calculates Hypotenuse value given two other right-triangle values.



Angle (θ) — Enters or calculates an Angle, providing the Adjacent Angle for both instances. Calculates an Angle given two other right-triangle values. Also enters the Starting Angle of the first hole of a Bolt Pattern, with 0° being the three o'clock position and the rotation going counterclockwise.

SETTING FRACTIONAL RESOLUTIONS

The *Machinist Calc Pro* is set to display fractional answers in 64ths of an Inch. All examples in this User's Guide are based on 1/64". However, you may select Fractional Resolution to be displayed in other formats (e.g., 1/16", 1/32", etc.). The methods for permanently and temporarily changing Fractional Resolution are shown in the following sections.

Permanently Set Fractional Resolution

To permanently set the Fractional Resolution, you must be in Preference Setting mode.

KEYSTROKE

DISPLAY

1. Access Preference Settings:

Conv **Stor** (Prefs)

FRAC 0-1/64 INCH*

2. Toggle through available Fractional Resolutions:



FRAC 0-1/2 INCH



FRAC 0-1/4 INCH



FRAC 0-1/8 INCH



FRAC 0-1/16 INCH



FRAC 0-1/32 INCH



(repeats options)

FRAC 0-1/64 INCH

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3. To permanently set the Fractional Resolution you have selected above, press **On/C** (or any key) to set the displayed Fractional Resolution and exit Preference Settings.

KEYSTROKE	DISPLAY
On/C	0.

4. To recall your selected Fractional Resolution:

Rcl /	STD 0-1/64 INCH
---------------------	------------------------

* 1/64" is the default setting. The display may differ from the example depending on what the resolution is currently set to.

Temporarily Set Fractional Resolution

You can also convert a fractional value to a different resolution temporarily while solving a problem. In the example below, add 1/64th to 44/64th of an Inch and then convert the answer to other Fractional Resolutions:

KEYSTROKE	DISPLAY
On/C On/C	0.
4 4 / 6 4	0-44/64 INCH
+ 1 / 6 4 =	0-45/64 INCH
Conv 1 (1/16)	0-11/16 INCH
Conv 2 (1/2)	0-1/2 INCH
Conv 3 (1/32)	0-23/32 INCH
Conv 4 (1/4)	0-3/4 INCH
Conv 6 (1/64)	0-45/64 INCH
Conv 8 (1/8)	0-3/4 INCH
On/C On/C *	0.

* Changing the Fractional Resolution on a displayed value does not alter your Permanent Fractional Resolution Setting (set in Preference Settings).

Note: This setting is temporary; it will revert back to your Permanent Fractional Setting upon press of **On/C** or when you turn the calculator off.

PREFERENCE SETTINGS

Press **Conv**, then **Stor** to access the Preferences menu. Continue pressing **Stor** to toggle through different Preferences. Press **+** or **=** keys to toggle between options of the different Preferences. Press **On/C** to exit Preferences. Your calculator will keep your Preference Settings until a Full Reset alters your settings to the default values (see **Appendix** for more information).

KEYSTROKE	DISPLAY
Conv Stor Stor (Prefs) (Functional Result Rounding)	F-RND 0.0000
+	F-RND 0.000
+	F-RND FLOAT
+ (repeats options)	F-RND 0.0000
Third press of Stor : (Default Unit Format)	US UnITS
+	METRC UnITS
+ (repeats options)	US UnITS
Fourth press of Stor : (Area Answer Format)	AREA Std.
+	AREA 0. SQ FEET
+	AREA 0. SQ INCH
+	AREA 0. SQ M
+ (repeats options)	AREA Std.
Fifth press of Stor : (Volume Answer Format)	VOL Std.
+	VOL 0. CU FEET
+	VOL 0. CU M
+	VOL 0. CU INCH
+ (repeats options)	VOL Std.
Sixth press of Stor : (Fractional Mode)	FRAC Std.

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KEYSTROKE	DISPLAY
+	FRAC COnST
+ (repeats options)	FRAC Std.
Seventh press of Stor : (Mathematical Operation)	MATH OrDER
+	MATH CHAln
+ (repeats options)	MATH OrDER

ENTERING DIMENSIONS

Note: Unlike other Calculated Industries/Construction Master calculators, the Machinist Calc Pro does not have a dedicated Feet key. Feet is a secondary function located above the **7** key, so you have to use the **Conv** key, then **7** to enter or calculate dimensions using Feet. Below are some examples.

Enter 2 Feet, then label as square and cubic units:

DIMENSIONS	KEYSTROKE	DISPLAY
2 Feet	2 Conv 7	2 FEET
2 square Feet	Conv 7	2 SQ FEET
2 cubic Feet	Conv 7	2 CU FEET

Enter 2 Feet, 3 Inches:

KEYSTROKE	DISPLAY
2 Conv 7 3 Inch	2 FEET 3 INCH

Linear Dimensions

Examples of how linear dimensions are entered (press **On/C** after each entry):

DIMENSIONS	KEYSTROKE
23 mils	2 3 /1000"
4.5 Inches	4 . 5 Inch
95 millimeters	9 5 mm
1,320 Feet	1 3 2 0 Conv 7
201 meters	2 0 1 Conv 9

Square and Cubic Dimensions

Examples of how square and cubic dimensions are entered (press **On/C** after each entry):

DIMENSIONS

KEYSTROKE

14 square Inches

1 **4** **Inch** **Inch**

11 square millimeters

1 **1** **mm** **mm**

1.5 cubic meters

1 **.** **5** **Conv** **9** **9** **9**

3 cubic Feet

3 **Conv** **7** **Conv** **7** **Conv** **7**

CONVERSIONS

Linear Conversions

Convert 10 Feet 6 Inches to other dimensions, including metric:

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1 **0** **Conv** **7** **6** **Inch**

10 FEET 6 INCH

Conv **/1000"** *

126.000 INCH

Conv **7** (Feet)

10.5 FEET

Conv **Inch**

126. INCH

Conv **mm**

3200.4 MM

Conv **5** (cm)

320.04 CM

Conv **9** (m)

3.2004 M

Converting a linear value using the **/1000" key will result in the decimal Inch equivalent of the value, rounded to three decimal places. Only unitless values are multiplied by 0.001 Inch when using this key.*

Convert 15 Feet 9-1/2 Inches to decimal Feet. Then convert back to Feet-Inch-Fractions.

KEYSTROKE

DISPLAY

On/C **On/C**

0.

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KEYSTROKE	DISPLAY
1 5 Conv 7 9 Inch 1 / 2	15 FEET 9-1/2 INCH
Conv 7 (Feet)	15.791667 FEET
Conv 7	15 FEET 9-1/2 INCH

Convert 17.32 Feet to Feet-Inch-Fractions:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 7 . 3 2 Conv 7 (Feet)	17.32 FEET
= Conv 7	17 FEET 3-27/32 INCH
Conv 7	17.32 FEET
Conv Inch	207.84 INCH
Conv 7 Conv 7	17 FEET 3-27/32 INCH

Convert 8-1/8 Inches to decimal Inches. Then convert to decimal Feet.

KEYSTROKE	DISPLAY
On/C On/C	0.
8 Inch 1 / 8	8-1/8 INCH
Conv Inch	8.125 INCH
Conv 7 (Feet)	0.6770833 FEET

Convert 9.0625 Inches to fractional Inches. Then convert to decimal Feet.

KEYSTROKE	DISPLAY
On/C On/C	0.
9 . 0 6 2 5 Inch	9.0625 INCH
Conv 7 (Feet)	0.7552083 FEET

Square and Cubic Conversions

Convert 6 square Feet to other square dimensions:

KEYSTROKE	DISPLAY
On/C On/C	0.
6 Conv 7 Conv 7 (Feet)	6 SQ FEET
Conv mm	557418.24 SQ MM
Conv 9 (m)	0.5574182 SQ M
Conv 5 (cm)	5574.1824 SQ CM

Convert 0.05 cubic meters to other dimensions:

KEYSTROKE	DISPLAY
On/C On/C	0.
0 5 Conv 9 9 9 (m)	0.05 CU M
Conv mm	50000000. CU MM
Conv 5 (cm)	50000. CU CM
Conv Inch	3051.1872 CU INCH
Conv 7 (Feet)	1.7657333 CU FEET

Weight Conversions

Convert 1.5 tons to pounds and kilograms:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 0 5 Conv 6 (tons)	1.5 TON
Conv 1 (kg)	1360.7771 KG
Conv 4 (lbs)	3000. LBS

Weight per Volume and Volume Conversions

Convert 2 cubic Feet of stainless steel to pounds, tons, kilograms, and metric tons if the steel weighs 7,480 kilograms per cubic meter.

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Store the weight per volume:

7 **4** **8** **0** **Stor** **0** **0** **0** **0** * (wt/vol)

7480. KG/ CU M

2. Enter steel volume:

2 **Conv** **7** **Conv** **7** **Conv** **7**

2 CU FEET

3. Convert to pounds, tons, kilograms and metric tons:

Conv **4** (lbs)

933.92229 LBS

Conv **6** (tons)

0.4669611 TON

Conv **1** (kg)

423.62003 KG

Conv **3** (met tons)

0.42362 MTON

4. Change the weight per volume back to the default value:

4 **9** **0** **Stor** **0** **0** (wt/vol)

490. LBS/ CU FEET

* The number of **0** presses may vary, depending on the last units displayed when wt/vol was last recalled/stored. By default, pounds per cubic foot is displayed first.

BASIC MATH OPERATIONS

Adding and Subtracting Dimensions

Add the following measurements:

- 6 Feet 2-1/2 Inches
- 11 Feet 5-1/4 Inches
- 18.25 Inches

Then subtract 2-1/8 Inches.

KEYSTROKE	DISPLAY
6 Conv 7 2 Inch 1 / 2 +	6 FEET 2-1/2 INCH
1 1 Conv 7 5 Inch 1 / 4 +	17 FEET 7-3/4 INCH
1 8 • 2 5 Inch =	19 FEET 2 INCH
— 2 Inch 1 / 8 =	18 FEET 11-7/8 INCH

Multiplying Dimensions

Multiply 5 Feet 3 Inches by 11 Feet 6-1/2 Inches:

KEYSTROKE	DISPLAY
5 Conv 7 3 Inch ×	5 FEET 3 INCH
1 1 Conv 7 6 Inch 1 / 2 =	60.59375 SQ FEET

Multiply 2 Feet 7 Inches by 10:

KEYSTROKE	DISPLAY
2 Conv 7 7 Inch × 1 0 =	25 FEET 10 INCH

Dividing Dimensions

Divide 30 Feet 4 Inches by 7 Inches:

KEYSTROKE	DISPLAY
3 0 Conv 7 4 Inch ÷ 7 Inch =	52.

Divide 20 Feet 3 Inches by 9:

KEYSTROKE	DISPLAY
2 0 Conv 7 3 Inch ÷ 9 =	2 FEET 3 INCH

Calculating Percentages

The **%** key can be used for finding a given percent of a number or for working add-on, discount or division percentage calculations. It can be used with any type of number, in any dimension (Feet, Inch, millimeter, etc.) and any type of convention (non-dimensioned, linear, square or cubic).

(cont'd)

Find 18% of 50 Feet:

KEYSTROKE	DISPLAY
On/C On/C	0.
5 0 Conv 7 X 1 8 %	9. FEET

Take 20% from 17 Feet 6 Inches:

KEYSTROKE	DISPLAY
1 7 Conv 7 6 Inch — 2 0 %	14 FEET 0 INCH

MEMORY OPERATION

Whenever the **M+** key is pressed, the displayed value will be added to the Memory. Other Memory functions:

FUNCTION	KEYSTROKE
Add to Memory	M+
Subtract from Memory	Conv M+
Recall total in Memory	Rcl M+
Display/Clear Memory	Rcl Rcl
Clear Memory	Conv Rcl

Memory is semi-permanent, clearing only when you do one of the following:

- turn off the calculator
- press **Rcl** **Rcl**
- press **Conv** **Rcl**
- press **Conv** **X** (Clear All).

When Memory is recalled (**Rcl** **M+**), consecutive presses of **M+** will display the calculated Average and total Count of the accumulated values.

Using M+

KEYSTROKE	DISPLAY
3 5 5 M+	M+ 355. M
2 5 5 M+	M+ 255. M

KEYSTROKE

DISPLAY

7 4 5 Conv M+ (M-)

M- 745. M

Rcl M+

TOTAL - 135. M

M+

AVG - 45. M

M+

COUNT 3. M

Rcl Rcl

M+ - 135.

Using Memory Storage Keys (M1- M9)

In addition to the standard cumulative Memory (as previously described), your calculator has nine independent Storage Registers – M1 through M9 – that can be used to permanently store single, noncumulative values. The following example shows the use of M1 (Stor 1). To use M2 - M9, replace the presses of the 1 key with presses of the corresponding number key (2-9).

You can replace a value in one of these Memory registers by storing a new value in place of the stored value.

FUNCTION

KEYSTROKE

Store single value in M1

Stor 1

Clear M1

0 Stor 1

Recall M1

Rcl 1

Store 175 into M1, recall the value, and then clear the value:

KEYSTROKE

DISPLAY

1 7 5 Stor 1

MEM-1 S 175.

Off On/C

0.

Rcl 1

MEM-1 S 175.

0 Stor 1

MEM-1 S 0.

PAPERLESS TAPE OPERATION

The Paperless Tape allows you to display and review the last thirty entries of a regular math or basic dimensional math sequence.

To access this mode after entering values, press **Conv** **=**. Then, press **+** or **=** to scroll forward or backward through the entries.

While in the Paperless Tape mode, the display will show the previously entered or calculated value, along with the sequential number of the entry (e.g., 01, 02, 03, etc.) and the math operator (+, -, x, ÷, %) in the upper left corner of the display.

Note: If **=** has been used in the middle of a sequence, **SUB** (for Subtotal) will display in the upper left. If **=** was the last operation performed, the display will show **TTL** (Total) as the last entry.

To exit this mode, press **=** to exit and maintain the last entry on the display. When exiting, the last entry (or TTL) will be displayed, allowing you to continue using the last tape value for another operation, if desired.

Note: The Paperless Tape is cleared when you do one of the following:

- **On/C** is pressed twice
- upon a new calculation (new equation string is started)
- when the calculator is shut off.

Add a sequence of values and access Paperless Tape mode to review your entries. Then, add another value to your total.

KEYSTROKE

DISPLAY

1. Add a sequence of values:

On/C **On/C**

0.

4 **Inch** **+**

4. INCH

KEYSTROKE	DISPLAY
7 Inch 1 / 2 +	11.5 INCH
6 Inch +	17.5 INCH
3 Inch 3 / 4 =	21.25 INCH

2. Access the Tape function:

Conv **=** TTL = 21.25 INCH

3. Scroll from first value to total:

+ 01 4. INCH
+ 02+ 7-1/2 INCH
+ 03+ 6. INCH
+ 04+ 3-3/4 INCH
+ TTL = 21.25 INCH

4. Scroll last two values:

= 04+ 3-3/4 INCH
= 03+ 6. INCH

5. Exit Tape function and add another value to your total:

= TTL = 21.25 INCH
+ 21.25 INCH
3 **Inch** **1** **/** **2** **=** 24.75 INCH

USING THE MACHINIST CALC PRO

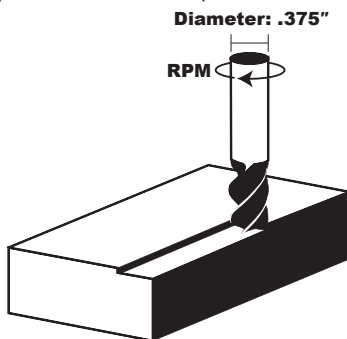
IMPORTANT: All examples are based on the default U.S. units mode, displaying entries and calculations in U.S. units. Also note that if an attempt is made to find a solution (using the Machinist functions) without having stored the minimum required values, the calculation will not be performed. Instead, the currently stored value for the selected function will be displayed. See **Key Definitions** section for function requirements.

RPM (SPINDLE SPEED)

RPM is the rotational speed of the spindle in revolutions per minute. In a milling machine or drill, the Spindle Speed is the rotation of the attached cutting tool. In a turning machine, it is the rotation of the attached workpiece. RPM can be calculated given values for Diameter and Cutting Speed.

RPM – Milling

Calculate the Spindle Speed (RPM) when milling with a .375" bit at a Cutting Speed of 300 sfm (surface feet per minute):



KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the bit Diameter:

◉ **3** **7** **5** **Diam**

DIA **0.375** INCH

2. Enter the Cutting Speed:

3 **0** **0** **Cut Speed**

CUT **300.** FEET/MIN

3. Calculate the Spindle Speed (RPM):

RPM

RPM 3056.

RPM

CUT **300.** FEET/MIN

RPM

DIA **0.375** INCH

Rcl **RPM** *

RPM **3055.7749**

* The calculated RPM is displayed as a rounded, whole number value.

Rcl **RPM** displays the stored RPM value in decimal floating point format.

RPM – Turning

Calculate the Spindle Speed (RPM) needed to turn a piece with a 5" Diameter at a recommended Cutting Speed of 650 sfm:

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	-----------

1. Enter the bit Diameter:

5 Diam	DIA 5. INCH
----------------------	--------------------

2. Enter the Cutting Speed:

6 5 0 Cut Speed	CUT 650. FEET/MIN
---	--------------------------

3. Calculate the Spindle Speed (RPM):

RPM *	RPM 497.
--------------	-----------------

* Repeated presses of **RPM** will toggle through the inputs and outputs, starting with the entered Cutting Speed.

RPM – Drilling

Calculate what the RPM (Spindle Speed) should be set to when drilling into material with a recommended Cutting Speed of 90 sfm using a .625" bit:

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	-----------

1. Enter the Diameter:

0 6 2 5 Diam	DIA 0.625 INCH
---	-----------------------

2. Enter the Cutting Speed:

9 0 Cut Speed	CUT 90. FEET/MIN
------------------------------------	-------------------------

3. Calculate the RPM:

RPM *	RPM 550.
--------------	-----------------

* Repeated presses of **RPM** will toggle through the inputs and outputs, starting with the entered Cutting Speed.

FEED RATE

Feed Rate is the speed of the cutting tool's movement relative to the workpiece as the tool makes a cut. You can calculate Feed Rate given values for Cutting Feed and RPM (Spindle Speed). If you don't know the Cutting Feed, you can calculate Feed Rate with Feed per Tooth (Chip Load), Number of Teeth and RPM.

Feed Rate – Based on Cutting Feed and RPM (for Turning)

Calculate the Feed Rate if you are turning a 1" steel round stock down with a Cutting Feed of 0.031 Inches per revolution and a rotational speed of 900 RPM (Spindle Speed):

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	-----------

1. Enter the Cutting Feed:

0 0 3 1 Cut Feed	CUT 0.031 INCH/REV
---	---------------------------

2. Enter the RPM:

9 0 0 RPM	RPM 900.
---------------------------------------	-----------------

3. Calculate the Feed Rate:

Feed Rate	FEED 27.9000 INCH/MIN
Feed Rate	RPM 900.
Feed Rate	CUT 0.031 INCH/REV

Feed Rate – Based on Cutting Feed and RPM (for Drilling)

Calculate the Feed Rate for a drilling operation that is using a recommended Cutting Feed of 0.004 Inch per revolution at 800 RPM (Spindle Speed):

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	-----------

1. Enter the Cutting Feed:

4 /1000" Cut Feed	CUT 0.004 INCH/REV
--	---------------------------

2. Enter the RPM:

8 0 0 RPM

RPM Σ 800.

3. Calculate the Feed Rate:

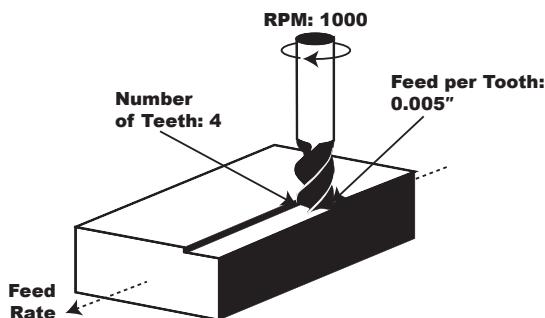
Feed Rate *

FEED 3.2000 INCH/MIN

* Repeated presses of **Feed Rate** will toggle through the inputs and outputs, starting with the entered RPM (Spindle Speed).

Feed Rate – Based on Feed per Tooth, RPM and # of Teeth

Calculate the Feed Rate for a four-fluted end mill using a Feed per Tooth (Chip Load) of 0.005 Inch turning at 1,000 RPM (Spindle Speed):



On/C On/C

0.

1. Enter the Feed per Tooth:

5 /1000" Feed/Tooth

FPT Σ 0.005 INCH

2. Enter the Number of Teeth:

4 #Teeth

TEETH Σ 4.

(cont'd)

(cont'd)

KEYSTROKE

DISPLAY

3. Enter the RPM:

1 0 0 0 RPM

RPM 1000.

4. Calculate the Feed Rate:

Feed Rate

FEED 20.0000 INCH/MIN

Feed Rate

RPM 1000.

Feed Rate

CUT 0.02 INCH/REV*

* This Cutting Feed is calculated based on the entered Feed/Tooth and Number of Teeth. It, along with RPM, is then used to calculate the Feed Rate.

CUTTING SPEED

Cutting Speed is the speed of the workpiece surface relative to the edge of the cutting tool during a cut, typically measured in surface feet per minute. You can calculate Cutting Speed by entering the Diameter of the tool or material you're using and the RPM (Spindle Speed).

Cutting Speed – Milling

Calculate the Cutting Speed for a mill using a .5" tool running at 1,250 RPM (Spindle Speed):

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Diameter of the tool:

• 5 Diam

DIA 0.5 INCH

2. Enter the RPM:

1 2 5 0 RPM

RPM 1250.

3. Calculate the Cutting Speed:

Cut Speed *

CUT 164. FEET/MIN

Cut Speed

DIA 0.5 INCH

KEYSTROKE**DISPLAY****Cut
Speed****RPM 1250.****Rcl Cut
Speed *****CUT 163.62462 FEET/MIN**

* The calculated Cutting Speed is displayed as a rounded, whole number value. **Rcl Cut Speed** displays the stored Cutting Speed value in decimal floating point format.

Cutting Speed – Turning

Calculate the Cutting Speed when turning a 4" rod at 300 RPM (Spindle Speed):

KEYSTROKE**DISPLAY****On/C On/C****0.**

1. Enter the Diameter of the rod:

4 Diam**DIA 4. INCH**

2. Enter the RPM:

3 0 0 RPM**RPM 300.**

3. Calculate the Cutting Speed:

**Cut
Speed *****CUT 314. FEET/MIN**

* Repeated presses of **Cut Speed** will toggle through the inputs and outputs, starting with the entered Diameter.

Cutting Speed – Drilling

Calculate the Cutting Speed using a 10.5 mm drill bit with the Spindle Speed set to 750 RPM:

KEYSTROKE**DISPLAY****On/C On/C****0.**

1. Enter the Diameter of the hole to be drilled:

1 0 . 5 mm Diam**DIA 10.5 MM***(cont'd)*

(cont'd)

KEYSTROKE

DISPLAY

2. Enter the RPM:

7 5 0 RPM

RPM 750.

3. Calculate the Cutting Speed:

Cut Speed *

CUT 81. FEET/MIN

* Repeated presses of **Cut Speed** will toggle through the inputs and outputs, starting with the entered Diameter.

Cutting Speed – Using Metric Mode

If you know you're going to be making your calculations in metric units, you can easily set your calculator to Metric Mode prior to entering values.

Calculate the Cutting Speed when using a #1 drill at 750 RPM (Spindle Speed):

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Set calculator to Metric Mode:

Conv Stor Stor Stor +

METRC Units

2. Enter the Drill Size:

1 Drill Size

1 DRILL SIZE 5.7912 MM

3. Store as the Diameter:

= Diam

DIA 5.7912 MM

4. Enter the RPM:

7 5 0 RPM

RPM 750.

5. Calculate the Cutting Speed:

Cut Speed *

CUT 14. M/MIN

6. Return calculator to U.S. Mode:

Conv Stor Stor Stor +

US Units

* Repeated presses of **Cut Speed** will toggle through the inputs and outputs, starting with the entered Diameter.

FEED PER TOOTH (CHIP LOAD)

Feed per Tooth, or Chip Load, is the thickness of material removed by each cutting surface. You can calculate Feed per Tooth given values for Number of Teeth and Cutting Feed. If the Cutting Feed is not known, the Feed per Tooth can be calculated given values for Number of Teeth, Feed Rate and RPM (Spindle Speed).

Feed per Tooth – Based on Cutting Feed and # of Teeth

Calculate Feed per Tooth (Chip Load) with a Cutting Feed of 0.024 Inch for 4 Teeth:

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the Cutting Feed:

0 **2** **4** **Cut Feed**

CUT **0.024** INCH/REV

2. Enter the Number of Teeth:

4 **#Teeth**

TEETH **4.**

3. Calculate the Feed per Tooth:

Feed/Tooth

FPT **0.0060** INCH

Feed/Tooth

TEETH **4.**

Feed/Tooth

CUT **0.024** INCH/REV

Feed per Tooth – Based on Feed Rate, RPM and # of Teeth

Calculate Feed per Tooth (Chip Load) with a 12.8 Inch per minute Feed Rate, 4 Teeth and a Spindle Speed of 800 RPM:

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Feed Rate:

1 2 . 8 Feed Rate

FEED 12.8 INCH/MIN

2. Enter the Number of Teeth:

4 #Teeth

TEETH 4.

3. Enter the Spindle Speed (RPM):

8 0 0 RPM

RPM 800.

4. Calculate the Feed per Tooth:

Feed/Tooth *

FPT 0.0040 INCH

* Repeated presses of **Feed/Tooth** will toggle through the inputs and outputs, starting with the entered Number of Teeth.

RADIAL CHIP THINNING

In a Milling operation when the depth of a cut is less than half the diameter of the tool, you can use the Radial Chip Thinning to determine a new, faster and more efficient Chipload or Feed/Tooth value.

Radial Chip Thinning –

Based on Feed per Tooth, Tool Diameter and Cut Depth

Calculate Radial Chip Thinning value with a Feed Per Tooth of 0.006 Inch, a 1" Tool Diameter and a Cut Depth of 0.1 Inch.

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Feed per Tooth:

KEYSTROKE**DISPLAY****6** **/1000"** **Feed/Tooth****FPT** **0.006 INCH**

2. Enter the Tool Diameter:

1 **Diam****DIA** **1. INCH**

3. Enter Cut Depth:

1 **Conv** **Cut Speed** **(Cut Depth)****DEPTH** **0.1 INCH**

4. Calculate the adjusted Feed per Tooth:

Cut Speed**ADJUST** **0.0100 INCH**

5. Calculate the Radial Chip Thinning Factor:

Cut Speed**RCTF** **1.6667 INCH****Cut Speed****DIA** **1. INCH****Cut Speed****FPT** **0.006 INCH**

CUTTING FEED

Cutting Feed is the distance the cutting tool or workpiece advances during one revolution of the spindle, typically measured in inches per revolution (IPR). You can calculate Cutting Feed given values for Feed per Tooth (Chip Load) and Number of Teeth. If these values are unknown, you can calculate Cutting Feed with Feed Rate and RPM (Spindle Speed).

Cutting Feed – Based on Feed per Tooth and # of Teeth

Calculate Cutting Feed with a Feed per Tooth (Chip Load) of 0.005 Inch and 4 Teeth:

KEYSTROKE**DISPLAY****On/C** **On/C****0.**

1. Enter the Feed per Tooth:

5 **/1000"** **Feed/Tooth****FPT** **0.005 INCH**

2. Enter the Number of Teeth:

4 **#Teeth****TEETH** **4.***(cont'd)*

(cont'd)

KEYSTROKE

DISPLAY

3. Calculate the Cutting Feed:

Cut Feed

CUT 0.0200 INCH/REV

Cut Feed

FPT \square 0.005 INCH

Cut Feed

TEETH \square 4.

Cutting Feed – Based on Feed Rate and RPM

Calculate a Cutting Feed using a 15" Feed Rate and a Spindle Speed of 800 RPM:

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Feed Rate:

1 5 Feed Rate

FEED \square 15. INCH/MIN

2. Enter the Spindle Speed (RPM):

8 0 0 RPM

RPM \square 800.

3. Calculate the Cutting Feed:

Cut Feed *

CUT 0.0188 INCH/REV

* Repeated presses of **Cut Feed** will toggle through the inputs and outputs, starting with the entered Feed Rate.

DRILL SIZES

The **Drill Size** key allows the selection of a desired Drill Size, which can be entered as a:

- Numeric value (whole digits 1 through 97)
- Letter between A and Z
- Fractional or decimal Inch value (maximum of 3-1/2 Inches)
- Millimeter value (maximum of 78 mm).

The selected Drill Size is displayed along with its decimal Inch equivalent. If the entered value doesn't match a Drill Size, the next smaller size is displayed. You can toggle through the available sizes in increasing order with either the **Drill Size** key or the **+** key. The **-** key displays the available sizes in decreasing order. To set the displayed Drill Size, press **On/C** (or any other key).

Numeric Drill Size Entry

Enter a #36 Drill and toggle through the next larger available sizes:

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	----

1. Enter the Drill Size:

3 6 Drill Size	36 DRILL SIZE S 0.1065 INCH
-------------------------------------	------------------------------------

2. Display the next larger available sizes:

Drill Size	2_75 MM DRILL SIZE S 0.1083 INCH
-------------------	---

Drill Size	7/64 DRILL SIZE S 0.1094 INCH
-------------------	--------------------------------------

Drill Size *	35 DRILL SIZE S 0.1100 INCH
---------------------	------------------------------------

* Repeated presses of **Drill Size** display the next larger Drill Sizes. The **+** and **-** keys will toggle forward and backward, respectively, through all available Drill Sizes.

Letter Drill Size Entry

You can enter letter Drill Sizes by selecting an alphabet character via Alpha Mode (**Conv** **8**) and then storing it using the **Drill Size** key. The desired letter can be selected by toggling through Alpha Mode until the letter is reached or by specifying the numerical order of the letter within the alphabet prior to entering Alpha Mode. Both methods are shown below.

Select Drill Size E by toggling through Alpha Mode. Then, select Drill Size G by entering the numerical order of the letter (the letter G is 7th in the alphabet).

(cont'd)

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Enter Alpha Mode:

Conv **8** (Alpha) ALPHA A

2. Toggle until the letter E is displayed:

8 **8** **8** **8** ALPHA E

3. Enter as Drill Size:

Drill Size E DRILL SIZE **0.2500** INCH

4. View next larger available sizes:

Drill Size 6_40 MM DRILL SIZE **0.2520** INCH

Drill Size 6_50 MM DRILL SIZE **0.2559** INCH

Drill Size * F DRILL SIZE **0.2570** INCH

5. Enter order of letter G and enter Alpha Mode:

7 **Conv** **8** (Alpha) ALPHA G

6. Enter as Drill Size:

Drill Size * G DRILL SIZE **0.2610** INCH

* Repeated presses of **Drill Size** display the next larger Drill Sizes. The **+** and **-** keys will toggle forward and backward, respectively, through all available Drill Sizes.

Inch Drill Size Entry

Enter hole sizes of 0.3 Inch, 1 Inch and 1-19/64 Inches. After entering each size, toggle through the available sizes to view the next larger and next smaller sizes.

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Enter the 0.3" hole size and view next larger and next smaller sizes:

3 **Inch** **Drill Size**

7_60 MM DRILL SIZE **S** **0.2992** INCH

Drill Size

N DRILL SIZE **S** **0.3020** INCH

— —

19/64 DRILL SIZE **S** **0.2969** INCH

2. Enter the 1" hole size and view next larger and next smaller sizes:

1 **Inch** **Drill Size**

1 DRILL SIZE **S** **1.0000** INCH

Drill Size

25_50 MM DRILL SIZE **S** **1.0039** INCH

— —

63/64 DRILL SIZE **S** **0.9844** INCH

3. Enter the 1-19/64" hole size and view next larger and next smaller sizes:

1 **Inch** **1** **9** **/** **6** **4** **Drill Size**

19/64 DRILL SIZE **S** **1.2969** INCH *

Drill Size

33_00 MM DRILL SIZE **S** **1.2992** INCH

— —

9/32 DRILL SIZE **S** **1.2813** INCH *

* Note that even though the Drill Size is shown on the upper left of the display without the whole Inch value (e.g. 19/64 instead of 1-19/64), the decimal inch equivalent reflects the actual size.

Millimeter Drill Size Entry

Enter a 5.7 mm hole size and toggle through the available sizes to view the next larger and next smaller sizes:

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the hole size as millimeters:

5 **mm** **Drill Size**

5_70 MM DRILL SIZE **S** **0.2244** INCH

2. View next larger and next smaller sizes:

Drill Size

5_75 MM DRILL SIZE **S** **0.2264** INCH

— —

2 DRILL SIZE **S** **0.2210** INCH

DRILL POINT

The Drill Point function calculates the Drill Point Cut Depth (length) of the stored Drill Size. By default, the calculation is based on a Cutting Angle of 118°. If a different Angle is desired, it can be stored using the Drill Point function (for example,

1 2 0 **Conv** **Drill Size** stores 120°).

Find the Drill Point Cut Depth for a 1/2" drill with a 118° Cutting Angle. Then, find the Cut Depth using a 127° Angle.

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the Drill Size:

1 **/** **2** **Drill Size**

1/2 DRILL SIZE **S** 0.5000 INCH

2. Enter 118° Angle and calculate the Drill Point Cut Depth:

1 **1** **8** **Conv** **Drill Size** (Drill Point)

DEPTH DRILL 0.1502 INCH

Drill Size

ANGLE DRILL **S** 118.°

Drill Size

1/2 DRILL SIZE **S** 0.5000 INCH

3. Enter 127° angle and calculate the Drill Point cut length:


1 **2** **7** **Conv** **Drill Size** (Drill Point)

DEPTH DRILL **S** 0.1246 INCH

THREAD SIZING

The **Thread Size** key allows you to enter a numeric, fractional or metric Thread Size and then toggle through the various available Thread characteristics, as shown in the tables provided later in this section.

When using the **Thread Size** key, the first entry is considered the Thread Size. Upon entering the Thread Size, the Threads per Inch (TPI) or Pitch is required. If the entered Thread Size is a standard size, continuous presses of the **Thread Size** key will toggle through the available common TPI or Pitches. Once the desired TPI/Pitch is reached, pressing **On/C** stores the Thread

Size. If the Thread Size you enter is not a standard size or if you have a non-common TPI/Pitch, you will need to directly enter the TPI/Pitch value, pressing  after entering it in order to store the Thread Size. Both of these entry methods are covered in the examples provided within this section.

The following specifies the entry ranges that the calculator allows for the Thread Size and TPI/Pitch values for numeric, fractional and metric Thread Sizes:

	Thread Size	TPI/Pitch
Numeric	0, 1, 2, 3, 4, 5, 6, 8, 10, 12, 14	less than 100
Fractional	0.06" to 6"	less than 100
Metric	1 mm to 300 mm	less than or equal to 10

Note: Entries outside of the ranges mentioned above will result in an Entry Error.

The following tables list the available Thread characteristics provided by the Thread Size function. Note that there are two separate listings, one for Internal Threads and one for External Threads. The listing shown within the Thread Size function is determined by the set Thread Classification (see **Thread Classification** section).

Internal Thread

Thread Size	Minimum Pitch Diameter
Cut Tap Drill Size*	Maximum Pitch Diameter
Roll Tap Drill Size*	Minimum Minor Diameter
Close Fit Drill Size*	Maximum Minor Diameter
Free Fit Drill Size*	Minimum Major Diameter

* If the resulting hole size is greater than 2 Inches or 50 mm, the actual hole size will be displayed instead of adjusting to the closest Drill Size.

(cont'd)

(cont'd)

External Thread

Thread Size	Minimum Pitch Diameter
Cut Rod Size	Maximum Major Diameter
Roll Shank Size	Minimum Major Diameter
Maximum Pitch Diameter	Maximum Minor Diameter

Thread Classification

With the *Machinist Calc Pro* you can choose between Internal and External Threads. Entering a U.S. Thread Size will allow you to choose among U.S. Thread Classes as shown below.

Thread Type	U.S. Thread Classes		
Internal	1B	2B*	3B
External	1A	2A	3A

Entering a Metric Thread will allow you to choose among Metric Thread Tolerance Classes as shown below.

Thread Type	Metric Thread Tolerance Classes						
Internal	3G	4G	5G	6G	7G	8G	9G
	3H	4H	5H	6H*	7H	8H	9H
External	3g	4g	5g	6g	7g	8g	9g
	3h	4h	5h	6h	7h	8h	9h
	3e	4e	5e	6e	7e	8e	9e
	3f	4f	5f	6f	7f	8f	9f

* Default settings

Changing Thread Classes

To display the current Thread Classification, press **Conv** **Bolt Pattern**. Repeated presses of **Bolt Pattern** will toggle between External and Internal Thread Types. You can change the number of a Thread Class by entering the number of the desired class/grade and pressing **Conv** **Bolt Pattern**.

Changing a U.S. Thread Classification

KEYSTROKE	DISPLAY
Conv X	ALL CLEARED
1. Recall the current Thread Classification:	
Conv Bolt Pattern (Thread Class)	INT 2B
2. Change to U.S. External Thread Class 2:	
Bolt Pattern	EXT 2A
3. Change to U.S. External Thread Class 1:	
1 Conv Bolt Pattern (Thread Class)	EXT 1A
4. Change to U.S. Internal Thread Class 1:	
Bolt Pattern	INT 1B

Changing a Metric Thread Classification

Changing a Metric Thread Tolerance Class is done in the same manner, with several selections available for Internal and External Threads.

KEYSTROKE	DISPLAY
Conv X	ALL CLEARED
1. Enter a Tolerance Grade of 4:	
4 Conv Bolt Pattern (Thread Class)	INT MM 4H
2. Toggle through the available Tolerance Positions for the entered Grade:	
Bolt Pattern	EXT MM 4G
Bolt Pattern	EXT MM 4H
Bolt Pattern	EXT MM 4E
Bolt Pattern	EXT MM 4F
Bolt Pattern	INT MM 4G
Bolt Pattern	INT MM 4H

(cont'd)

(cont'd)

KEYSTROKE

DISPLAY

3. Enter a Tolerance Grade of 6 and toggle through the available Tolerance Positions for the entered Grade:

6 **Conv** **Bolt Pattern** (Thread Class)

INT MM 6H

Bolt Pattern

EXT MM 6G

Bolt Pattern

EXT MM 6H

Bolt Pattern*

EXT MM 6E

* Repeated presses of **Bolt Pattern** will continue to toggle through the available Tolerance Positions of the specified Grade.

Note: The number 3 can be entered to select both U.S. and Metric classes. If no Thread Size is stored when accessing the Thread Classification function, the U.S. Class will always be displayed. In order to select a Tolerance Class with a Grade of 3 for a Metric Thread Size, the Metric Thread Size must be stored prior to accessing the Thread Classification function.

Numeric Thread Size

Enter a #8-32 screw and toggle through the available Internal Thread (Class 2B) characteristics, then switch to External Thread (Class 2A) and toggle through the available Thread characteristics.

Note: The default U.S. Thread Class is 2B (Internal). To view the current Thread Class, press **Conv** **Bolt Pattern**. To change the class, press **Bolt Pattern** again.

Thread Size calculations for Pitch, Major, and Minor Diameter attributes are compliant with ANSI/ASME B.1.1-2003 and ANSI/ASME B.1.13M-2005.

KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARED

1. Verify Thread Class is set to 2B:

Conv **Bolt Pattern** (Thread Class)

INT 2B

2. Enter the Thread Size:

8 Thread Size

SIZE 8 –

3. Enter the TPI and store the final Thread Size:

3 **2** Thread Size

THRED SIZE **8 – 32**

4. Find the available Internal Thread characteristics:

Thread Size (Cut Tap Drill Size)

TAP DRILL SIZE **29**

Thread Size (Roll Tap Drill Size)

R-TAP DRILL SIZE **3.75 MM**

Thread Size (Close Fit Drill Size)

CLOSE DRILL SIZE **18**

Thread Size (Free Fit Drill Size)

FREE DRILL SIZE **16**

Thread Size (Min. Internal Pitch Diameter)

PTCH- SIZE **0.1437 INCH**

Thread Size (Max. Internal Pitch Diameter)

PTCH+ SIZE **0.1475 INCH**

Thread Size (Min. Internal Minor Diameter)

MINR- SIZE **0.1300 INCH**

Thread Size (Max. Internal Minor Diameter)

MINR+ SIZE **0.1390 INCH**

Thread Size (Min. Internal Major Diameter)

MAJR- SIZE **0.1640 INCH**

5. Switch to Thread Class 2A and find the available External Thread characteristics:

Conv Bolt Pattern Bolt Pattern (Thread Class)

EXT **2A**

Thread Size

THRED SIZE **8 – 32**

Thread Size (Rod Size for thread cutting)

ROD SIZE **0.1640 INCH**

Thread Size (Rod Size for cold forming)

CFORM SIZE **0.1412 INCH**

Thread Size (Max. External Pitch Diameter)

PTCH+ SIZE **0.1428 INCH**

Thread Size (Min. External Pitch Diameter)

PTCH- SIZE **0.1399 INCH**

Thread Size (Max. External Major Diameter)

MAJR+ SIZE **0.1631 INCH**

Thread Size (Min. External Major Diameter)

MAJR- SIZE **0.1571 INCH**

Thread Size (Max. External Minor Diameter)

MINR+ SIZE **0.1259 INCH**

Fractional Thread Size

Find the available Internal and External Thread characteristics for a 1/4-28 screw.

KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARED

1. Verify Thread Class is set to 2B:

Conv **Bolt Pattern** (Thread Class)

INT 2B

2. Enter the Thread Size:

1 **/** **4** **Thread Size**

SIZE 1/4 – INCH

3. Enter the TPI and store the final Thread Size:

2 **8** **Thread Size**

THRED SIZE S 1/4 – 28 INCH

4. Find the available Internal Thread characteristics:

Thread Size (Cut Tap Drill Size)

TAP DRILL SIZE 3

Thread Size (Roll Tap Drill Size)

R-TAP DRILL SIZE 5.9 MM

Thread Size (Close Fit Drill Size)

CLOSE DRILL SIZE F

Thread Size (Free Fit Drill Size)

FREE DRILL SIZE H

Thread Size (Min. Internal Pitch Diameter)

PTCH- SIZE 0.2268 INCH

Thread Size (Max. Internal Pitch Diameter)

PTCH+ SIZE 0.2311 INCH

Thread Size (Min. Internal Minor Diameter)

MINR- SIZE 0.2110 INCH

Thread Size (Max. Internal Minor Diameter)

MINR+ SIZE 0.2200 INCH

Thread Size (Min. Internal Major Diameter)

MAJR- SIZE 0.2500 INCH

5. Switch to Thread Class 2A and find the available External Thread characteristics:

Conv **Bolt Pattern** **Bolt Pattern** (Thread Class)

EXT 2A

Thread Size

THRED SIZE S 1/4 – 28 INCH

Thread Size (Rod Size for Thread Cutting)

ROD SIZE 0.2500 INCH

Thread Size (Rod Size for Cold Forming)

CFORM SIZE 0.2239 INCH

Thread Size (Max. External Pitch Diameter)

PTCH+ SIZE 0.2258 INCH

KEYSTROKE

DISPLAY

Thread Size (Min. External Pitch Diameter)	PTCH- SIZE 0.2225 INCH
Thread Size (Max. External Major Diameter)	MAJR+ SIZE 0.2490 INCH
Thread Size (Min. External Major Diameter)	MAJR- SIZE 0.2425 INCH
Thread Size (Max. External Minor Diameter)	MINR+ SIZE 0.2065 INCH

Metric Thread Size

Find the available Internal and External Thread characteristics for a M5 x 0.75 screw with a Tolerance Class of 4H.

Note: The default Metric Tolerance Class is 6H (Internal). To view the current Tolerance Class, press **Conv** **Bolt Pattern** after entering the desired Metric Thread Size. To change the class, press **Bolt Pattern** again.

KEYSTROKE

DISPLAY

Conv **X** **ALL CLEARED**

1. Set Tolerance Class to Internal 4H:

4 **Conv** **Bolt Pattern** (Thread Class) **INT MM 4H**

2. Enter the Thread Size:

5 **mm** **Thread Size** **SIZE 5. – MM**

3. Enter the Thread Pitch and store the final Thread Size:

0 **•** **7** **5** **Thread Size** **THRED SIZE 5. – 0.75 MM**

4. Find the available Internal Thread characteristics:

Thread Size (Cut Tap Drill Size) **TAP DRILL SIZE 4.25 MM**

Thread Size (Roll Tap Drill Size) **R-TAP DRILL SIZE 14**

Thread Size (Close Fit Drill Size) **CLOSE DRILL SIZE 5.3 MM**

Thread Size (Free Fit Drill Size) **FREE DRILL SIZE 5.8 MM**

Thread Size (Min. Internal Pitch Diameter) **PTCH- SIZE 4.5130 MM**

Thread Size (Max. Internal Pitch Diameter) **PTCH+ SIZE 4.5605 MM**

Thread Size (Min. Internal Minor Diameter) **MINR- SIZE 4.1880 MM**

Thread Size (Max. Internal Minor Diameter) **MINR+ SIZE 4.3060 MM**

(cont'd)

(cont'd)

KEYSTROKE

DISPLAY

Thread Size (Min. Internal Major Diameter) **MAJR- SIZE 5.0000 MM**

5. Switch to External 4g Tolerance Class and find the available External Thread characteristics:

Conv **Bolt Pattern** **Bolt Pattern** (Thread Class) **EXT MM 4G**

Thread Size **THRED SIZE 5. – 0.75 MM**

Thread Size (Rod Size for Thread Cutting) **ROD SIZE 5.0000 MM**

Thread Size (Rod Size for Cold Forming) **CFORM SIZE 4.4520 MM**

Thread Size (Max. External Pitch Diameter) **PTCH+ SIZE 4.4910 MM**

Thread Size (Min. External Pitch Diameter) **PTCH- SIZE 4.4350 MM**

Thread Size (Max. External Major Diameter) **MAJR+ SIZE 4.9780 MM**

Thread Size (Min. External Major Diameter) **MAJR- SIZE 4.8880 MM**

Thread Size (Max. External Minor Diameter) **MINR+ SIZE 4.1660 MM**

Custom Thread Percentage

The *Machinist Calc Pro* uses a default Thread Grip Percentage of 75% when calculating Tap Drill sizes. With the custom Percentage Thread function, you can enter a different value to calculate Tap Drill sizes.

Calculate the Tap Drill Size for a 1/4-26 screw, then change the Thread Grip Percentage to 50% and calculate the new Tap Drill Size.

KEYSTROKE

DISPLAY

Conv **X** **ALL CLEARED**

1. Enter the Thread Size and calculate the Cut Tap and Roll Tap Drill Sizes:

1 **/** **4** **Thread Size** **SIZE 1/4 – INCH**

2 **6** **Thread Size** **THRED SIZE 1/4 – 26 INCH**

Thread Size (Cut Tap Drill Size) **TAP DRILL SIZE 3**

Thread Size * (Roll Tap Drill Size) **R-TAP DRILL SIZE 5.9 MM**

2. Change the Thread Grip Percentage to 50% and calculate the new Cut Tap and Roll Tap Drill Sizes:

5 0 **Conv** **Thread Size** (% Thread)

THRD% SIZE **50.**

Thread Size

THRED SIZE **1/4 – 26 INCH**

Thread Size (Cut Tap Drill Size)

TAP DRILL SIZE 1

Thread Size * (Roll Tap Drill Size)

R-TAP DRILL SIZE 6. MM

* Repeated presses of **Thread Size** will toggle through the inputs and outputs, starting with the Close Fit Drill Size.

WIRE SIZES AND 3-WIRE MEASUREMENTS

Wire Size

If you know your Thread Size, you can find the Ideal, Maximum and Minimum Wire Sizes you can use for that size Screw Thread.

Find the Ideal, Maximum and Minimum Wire Sizes for measuring a 3/8" Thread with 16 Threads per Inch:

On/C **On/C**

0.

1. Enter the Thread Size:

3 / 8 **Thread Size**

SIZE 3/8 – INCH

2. Enter the Threads per Inch and store the final Thread Size:

1 6 **Thread Size**

THRED SIZE **3/8 – 16 INCH**

3. Find the Ideal, Maximum and Minimum Wire Sizes:

Conv **Feed Rate** (Wire Size)

IDEAL SIZE 0.0361 INCH

Feed Rate

MAX SIZE 0.0563 INCH

Feed Rate

MIN SIZE 0.0350 INCH

3-Wire Measurement – Known Thread Size and Wire Size

You can find the Minimum and Maximum 3-Wire Measurements as well as the Pitch Diameters if you know the Thread Size and the Wire Size you want to use.

Note: When solving for 3-Wire Measurements and Pitch Diameters, the calculator assumes the equivalent External Thread Type if an Internal Thread Type is set (i.e., Internal 2B is assumed External 2A for U.S. Threads; Internal 6H is assumed External 6H for Metric Threads).

Find the Minimum and Maximum allowable 3-Wire Measurements and Pitch Diameters for a 3/8-16, Class 2A (External) screw using 0.040" wire:

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Enter the Thread Size:

3 / 8 Thread Size	SIZE 3/8 – INCH
--------------------------	------------------------

2. Enter the Threads per Inch and store the final Thread Size:

1 6 Thread Size	THRED SIZE 3/8 – 16 INCH
------------------------	---------------------------------

3. Set the Thread Class to 2A:

2 Conv Bolt Pattern * (Thread Class)	EXT 2A
---	---------------

* If necessary, continue pressing **Bolt Pattern** until the desired External Thread Class is displayed.

4. Enter the Wire Size*:

• 0 4 Conv Feed Rate (Wire Size)	WIRE SIZE 0.04 INCH
---	----------------------------

5. Find the Minimum 3-Wire Measurement:

Conv RPM (3-W Measure)	3WMIN SIZE 0.3946 INCH
-------------------------------	-------------------------------

6. Find the Maximum 3-Wire Measurement:

RPM	3WMAX SIZE 0.3990 INCH
------------	-------------------------------

7. Find the Minimum Pitch Diameter:

RPM	PTCH- SIZE 0.3287 INCH
------------	-------------------------------

8. Find the Maximum Pitch Diameter:

RPM

PITCH+ SIZE 0.3331 INCH

RPM

WIRE SIZE \square 0.04 INCH

** If no Wire Size is entered, the calculated Ideal Wire Size will be used to find the 3-Wire Measurement.*

Pitch Diameter – Known 3-Wire Measurement and Wire Size

You can also find the measured Pitch Diameter if you know the 3-Wire Measurement and the Wire Size used to obtain the measurement.

Find the Pitch Diameter of a 3/8-16, Class 2A (External) screw with a 3-Wire Measurement of 0.3975 Inch obtained using a 0.040" wire:

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Thread Size:

3 / 8 Thread Size

SIZE 3/8 – INCH

2. Enter the Threads per Inch and store the final Thread Size:

1 6 Thread Size

THRED SIZE \square 3/8 – 16 INCH

3. Set the Thread Class to 2A:

2 Conv Bolt Pattern * (Thread Class)

EXT 2A

** If necessary, continue pressing **Bolt Pattern** until the desired External Thread Class is displayed.*

4. Enter the Wire Size*:

• 0 4 Conv Feed Rate (Wire Size)

WIRE SIZE \square 0.04 INCH

5. Enter the 3-Wire Measurement:

• 3 9 7 5 Conv RPM

3WIRE SIZE \square 0.3975 INCH

(3-W Measure)

(cont'd)

(cont'd)

KEYSTROKE**DISPLAY**

6. Find the Pitch Diameter:

RPM

P-DIA SIZE 0.3316 INCH

RPM

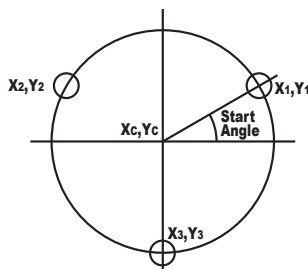
WIRE SIZE \square 0.04 INCH

** If no Wire Size is entered, the calculated Ideal Wire Size will be used to find the Pitch Diameter.*

BOLT PATTERN

With the *Machinist Calc Pro*, you can determine a Bolt Pattern by entering the Bolt Circle Diameter, the Number of Bolt Holes and the Angle of the first bolt hole (optional). You can also enter an optional Center x and y-coordinate of the Bolt Pattern.

In addition to calculating the x and y-coordinates for each bolt hole, the Bolt Pattern function also calculates the hole center-to-center spacing (i.e. on-center distance from hole to hole).



Bolt Pattern

Calculate the Bolt Pattern for a layout with a 3.5" Diameter, a 20° Start Angle and 3 Bolts. The Center x-coordinate is 10 Inches and the center y-coordinate is 15 Inches.

Note: When determining angles, 0° is at the 3 o'clock position and the rotation goes counterclockwise.

KEYSTROKE**DISPLAY**

On/C On/C

0.

1. Enter the Center x-coordinate:

KEYSTROKE

DISPLAY

1 **0** **Inch** **Adj****ADJ** **10. INCH**

2. Enter the Center y-coordinate:

1 **5** **Inch** **Opp****OPP** **15. INCH**

3. Enter the Start Angle:

2 **0** **Angle****ANGLE** **20.°**

4. Enter Bolt Circle Diameter:

3 **•** **5** **Diam****DIA** **3.5 INCH**

5. Enter the Number of Bolts:

3 **Bolt Pattern****BOLTS** **3.**

6. Calculate Center-to-Center Spacing and the x and y coordinates:

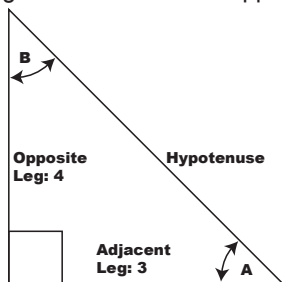
Bolt Pattern (Center-to-Center Spacing)**OC-OC** **3.0311 INCH****Bolt Pattern****X-01** **11.6445 INCH****Bolt Pattern****Y-01** **15.5985 INCH****Bolt Pattern****X-02** **8.6594 INCH****Bolt Pattern****Y-02** **16.1249 INCH****Bolt Pattern****X-03** **9.6961 INCH****Bolt Pattern****Y-03** **13.2766 INCH****Bolt Pattern****DIA** **3.5 INCH****Bolt Pattern****Xoc** **10. INCH****Bolt Pattern****Yoc** **15. INCH****Bolt Pattern****ANGLE** **20°**

RIGHT TRIANGLE FUNCTIONS

With the *Machinist Calc Pro*, you can easily solve Right Triangle problems by simply entering two of four variables: Adjacent, Opposite, Hypotenuse or Angle.

Right Triangle – Based on Adjacent and Opposite Legs

Calculate the Hypotenuse, Angle and Adjacent Angle of a right triangle with an Adjacent Leg of 3 Inches and an Opposite Leg of 4 Inches:



KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the Adjacent Leg length:

3 **Inch** **Adj**

ADJ **3** 3. INCH

2. Enter the Opposite Leg length:

4 **Inch** **Opp**

OPP **4** 4. INCH

3. Solve for the Hypotenuse:

Hyp

HYP 5.0000 INCH

4. Solve for the Angle:

Angle

ANGLE **53.130102°**

5. Solve for the Adjacent Angle:

Angle

ADJ<Ø 36.8699°

Right Triangle – Based on Hypotenuse and Angle

Calculate the Adjacent Angle, Adjacent Leg and Opposite Leg of a right triangle with a Hypotenuse of 12 Inches and a known Angle of 35.34°:

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter the Hypotenuse:	
1 2 Inch Hyp	HYP 12. INCH
2 Enter the known Angle:	
3 5 ° 3 4 Angle	ANGLE 35.34°
3. Solve for the Adjacent Angle:	
Angle	ADJ<Ø 54.6600°
4. Solve for the Adjacent Leg:	
Adj	ADJ 9.7888 INCH
5. Solve for the Opposite Leg:	
Opp	OPP 6.9411271 INCH

CIRCLE CALCULATIONS

Circumference and Area – Based on Diameter

Find the Area, Circumference and Radius of a circle with a Diameter of 11 Inches:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 1 Diam	DIA 11. INCH
Diam	AREA 95.0332 SQ INCH
Diam	CIRC 34.5575 INCH
Conv Diam (Radius)	RAD 5.5 INCH

Circumference and Area – Based on Radius

Find the Diameter, Area and Circumference of a circle with a Radius of 3-1/4 Inches:

KEYSTROKE	DISPLAY
On/C On/C	0.
3 Inch 1 / 4 Conv Diam (Radius)	RAD 3 3-1/4 INCH
Diam	DIA 6 1/2 INCH
Diam	AREA 33.1831 SQ INCH
Diam	CIRC 20-27/64 INCH

BASIC D:M:S AND TRIGONOMETRY EXAMPLES

Converting Degrees:Minutes:Seconds

Convert 23° 42' 39" to decimal degrees:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 3 ° 4 2 ' 3 9 "	DMS 23.42.39
Conv ° (dms ◀ ▶ deg)	23.710833°

Convert 44.29° to degrees:minutes:seconds format:

KEYSTROKE	DISPLAY
On/C On/C	0.
4 4 ° 2 9 Conv ° (dms ◀ ▶ deg)	DMS 44.17.24°

Note: Improperly formatted entries will be redisplayed in the correct convention after any operator key is pressed. For example, 30° 89' entered will be corrected and displayed as 31° 29' 0" or 31.483333°.

Time Calculations Using D:M:S

Add 7 Hours 45 Minutes 33 Seconds to 11 Hours 16 Minutes 20 Seconds:

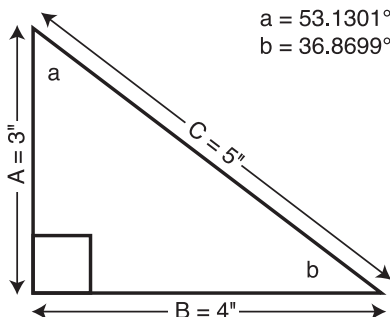
KEYSTROKE	DISPLAY
On/C On/C	0.

7 0 4 5 0 3 3 +
 1 1 0 1 6 0 2 0 =

DMS 7.45.33°
 DMS 19.01.53°

Trigonometric Functions

The following drawing and formulas list basic trigonometric formulas, for your reference:



Given side A and angle a, find:

Side C $A \div a \text{ Conv } \frac{\text{Feed}}{\text{Tooth}} (\text{Cos}) =$
 (e.g., 3 Inch \div 5.3 \div 1.3 Conv $\frac{\text{Feed}}{\text{Tooth}} (\text{Cos}) =$)
 Side B $A \times a \text{ Conv } \frac{\text{Cut}}{\text{Feed}} (\text{Tan}) =$
 Angle b $90^\circ - a =$

Given side A and angle b, find:

Side B $A \div b \text{ Conv } \frac{\text{Cut}}{\text{Feed}} (\text{Tan}) =$
 Side C $A \div b \text{ Conv } \frac{\text{Teeth}}{\text{Sine}} =$
 Angle a $90^\circ - b =$

Given side B and angle a, find:

Side A $B \div a \text{ Conv } \frac{\text{Cut}}{\text{Feed}} (\text{Tan}) =$
 Side C $B \div a \text{ Conv } \frac{\text{Teeth}}{\text{Sine}} =$

(cont'd)

(cont'd)

Given side C and angle a, find:

Side A C \times a Conv $\frac{\text{Feed}}{\text{Tooth}}$ (Cos) =

Side B C \times a Conv #Teeth (Sine) =

Given side A and side C, find:

Angle a A \div C = Conv $\frac{\text{Opp}}{\text{Hyp}}$ (ArcCos)

Angle b A \div C = Conv $\frac{\text{Adj}}{\text{Hyp}}$ (ArcSine)

Given side B and angle b, find:

Side C B \div b Conv $\frac{\text{Feed}}{\text{Tooth}}$ (Cos) =

Side A B \times b Conv $\frac{\text{Cut}}{\text{Feed}}$ (Tan) =

APPENDIX A – DEFAULT SETTINGS


After a Clear All (Conv \times), your calculator will return to the following settings:

STORED VALUES	DEFAULT VALUE
Number of Teeth	1.
Drill Point Angle	118°
Weight per Volume	490 pounds per cubic foot
% Thread	75%
Thread Classification	
US Threads	Internal 2B
Metric Threads	Internal 6H

If you replace your batteries or perform a Full Reset* (press Off , hold down \times and press On/C) your calculator will return to the following settings (in addition to those listed above):


PREFERENCE SETTINGS	DEFAULT VALUE
Fractional Resolution	1/64"
Functional Result Rounding	0.0000
Default Unit Format	US
Area Answer Format	Standard

PREFERENCE SETTINGS	DEFAULT VALUE
Volume Answer Format	Standard
Fractional Mode	Standard
Mathematical Operation	Order of Operations Method

* Depressing the Reset button located above the  key will also perform a Full Reset.

APPENDIX B – PREFERENCE SETTINGS

The *Machinist Calc Pro* has Preference Settings that allow you to customize or set desired unit formats and calculations. If you replace your batteries or perform a Full Reset* (press **Off**, hold down **X**, and press **On/C**), your calculator will return to the following settings (in addition to those listed on the previous page), with the default setting for each preference listed first:

* Depressing the Reset button located above the  key will also perform a Full Reset.

PREFERENCE	OPTIONS
1) Fractional Resolution	<ul style="list-style-type: none"> – 1/64: displays fractional values to the nearest 64th of an Inch. – 1/2: displays fractional values to the nearest half Inch. – 1/4: displays fractional values to the nearest quarter of an Inch. – 1/8: displays fractional values to the nearest 8th of an Inch. – 1/16: displays fractional values to the nearest 16th of an Inch. – 1/32: displays fractional values to the nearest 32nd of an Inch.

(cont'd)

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- 2) Functional Result Rounding
 - **0.0000**: calculation results using Machinist functions are displayed to four decimal places.
 - **0.000**: calculation results using Machinist functions are displayed to three decimal places.
 - **FLOAT**: calculation results using Machinist functions are always displayed to the maximum number of decimal places.
- 3) Default Unit Format
 - **US**: unitless values stored within Machinist functions are automatically assigned the corresponding default U.S. units of the selected function.
 - **METRIC**: unitless values stored within the Machinist functions are automatically assigned the corresponding default Metric units of the selected function.
- 4) Area Answer Format
 - **Standard**: if units entered are the same – e.g., Feet x Feet – area answers will remain in this format (Square Feet), but if units entered are different – e.g., Inches x Feet – area answers will be displayed in Square Feet.
 - **Square Feet**: area answers always displayed in Square Feet, regardless of unit entry – e.g., Inches x Inches = Square Feet.
 - **Square Inches**: area answers always displayed in Square Inches, regardless of unit entry – e.g., Feet x Feet = Square Inches.
 - **Square Meters**: area answers always displayed in Square Meters, regardless of unit entry – e.g., Feet x Feet = Square Meters.

- 5) Volume Answer Format
- **Standard:** if units entered are the same – e.g., Feet x Feet x Feet – the answer will remain in this format (Cubic Feet), but if units entered are different – e.g., Feet x Feet x Inches – volume answer will be displayed in Cubic Feet.
 - **Cubic Feet:** volume answers always displayed in Cubic Feet, regardless of unit entry – e.g., Inches x Inches x Inches = Cubic Feet.
 - **Cubic Meters:** volume answers always displayed in Cubic Meters, regardless of unit entry – e.g., Feet x Feet x Feet = Cubic Meters.
 - **Cubic Inches:** volume answers always displayed in Cubic Inches, regardless of unit entry – e.g., Feet x Feet x Feet = Cubic Inches.
- 6) Fractional Mode
- **Standard:** fractions are displayed to the nearest fraction.
 - **Constant:** fractions are displayed in the set Fractional Resolution.
- 7) Mathematical Operation
- **Order:** the calculator uses the Order of Operations Method ($10 + 4 \times 5 = 30$).
 - **Chain:** the calculator uses the Chaining Method (as entered: $10 + 4 \times 5 = 70$).

APPENDIX C – CARE INSTRUCTIONS

Please follow the guidelines listed in this section for proper care and operation of your calculator. Not following the instructions listed below may result in damage not covered by your warranty. Refer to the **WARRANTY** section on page 69 for more details.

Do not expose calculator to temperatures outside the operating temperature range of 32°F – 104°F (0°C – 40°C).

Do not expose calculator to high moisture such as submersion in water, heavy rain, etc.

APPENDIX D – ACCURACY/ERRORS, AUTO SHUT-OFF, BATTERIES, RESET

ACCURACY/ERRORS

Accuracy/Display Capacity — Your calculator has a twelve-digit display made up of eight digits (normal display) and four fractional digits. You may enter or calculate values up to 99,999,999.99. Each calculation is carried out internally to 12 digits.

Errors — When an incorrect entry is made, or the answer is beyond the range of the calculator, an error message will display. To clear an error condition you must press the **On/C** key once. At this point, you must determine what caused the error and re-key the problem.

Error Codes

DISPLAY	ERROR TYPE
OFLO	Overflow (too large)
MATH Error	Divide by 0
DIM Error	Dimension error
ENT Error	Invalid entry error
NONE	Attempt to access cleared Thread Size or Drill Size Value; Invalid RCT Calculation

Auto-Range — If an “overflow” is created because of an input and calculation with small units that are out of the standard eight-digit range of the display, the answer will be automatically expressed in the next larger units (instead of showing “OFLO”) — e.g., 200,000,000 mm is shown as 200,000 m. Also applies to inches and feet.

AUTO SHUT-OFF

Your calculator is designed to shut itself off after about 8-12 minutes of non-use.

BATTERIES

The *Machinist Calc Pro* uses two LR-44 batteries. Should your calculator display become very dim or erratic, replace the batteries.

Note: Please use caution when disposing of your old batteries, as they contain hazardous chemicals.

Replacement batteries are available at most discount or electronics stores. You may also call Calculated Industries at **1-775-885-4900**.

Battery Replacement Instructions

To replace the batteries, slide open the battery door (at top backside of unit) and replace with new batteries. Make sure the batteries are facing positive side up.



RESET

If your calculator should ever “lock up,” press Reset – a small hole located above the **Cut Speed** key – to perform a total reset.

REPAIR AND RETURN

RETURN GUIDELINES

1. Please read the **Warranty** in this User's Guide to determine if your Calculated Industries product remains under warranty **before** calling or returning any device for evaluation or repairs.
2. If your product won't turn on, check the batteries as outlined in the User's Guide.
3. If you need more assistance, please go to the website listed below.
4. If you believe you need to return your product, please call a Calculated Industries representative between the hours of 7:00am to 4:30pm Pacific Time for additional information and a Return Merchandise Authorization (RMA).

Call Toll Free: 1-800-854-8075

Outside USA: 1-775-885-4900

www.calculated.com/warranty

WARRANTY

Warranty Repair Service – U.S.A.

Calculated Industries (“CI”) warrants this product against defects in materials and workmanship for a period of **one (1) year from the date of original consumer purchase in the U.S.** If a defect exists during the warranty period, CI at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured calculator) the product at no charge.

THE WARRANTY **WILL NOT APPLY** TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, A BLACK “INK SPOT” OR VISIBLE CRACKING OF THE LCD, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE.

To obtain warranty service in the U.S., please go to the website. A repaired or replacement product assumes the remaining warranty of the original product or 90 days, whichever is longer.

Non-Warranty Repair Service – U.S.A.

Non-warranty repair covers service beyond the warranty period, or service requested due to damage resulting from misuse or abuse. Contact Calculated Industries at the number listed above to obtain current product repair information and charges. Repairs are guaranteed for 90 days.

Repair Service – Outside the U.S.A.

To obtain warranty or non-warranty repair service for goods purchased outside the U.S., contact the dealer through which you initially purchased the product. If you cannot reasonably have the product repaired in your area, you may contact CI to obtain current product repair information and charges, including freight and duties.

Disclaimer

CI MAKES NO WARRANTY OR REPRESENTATION, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT'S QUALITY, PERFORMANCE, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. AS A RESULT, THIS PRODUCT, INCLUDING BUT NOT LIMITED TO, KEYSTROKE PROCEDURES, MATHEMATICAL ACCURACY AND PREPROGRAMMED MATERIAL, IS SOLD "AS IS," AND YOU THE PURCHASER ASSUME THE ENTIRE RISK AS TO ITS QUALITY AND PERFORMANCE.

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